THE CLUPEOID FISHES DESCRIBED BY FRANCIS DAY

By P. K. TALWAR & P. J. P. WHITEHEAD

ABSTRACT

FRANCIS DAY described six new clupeoid fishes: *Spratelloides malabaricus, Clupea sindensis, Clupea variegata, Chatoessus modestus, Pellona sladeni* and *Engraulis auratus*. For the first of these the new genus *Dayella* is proposed. Except for the last, all are considered valid. Lectotypes have been chosen from among Day's figured specimens now in the Zoological Survey in Calcutta, except in the case of *E. auratus* for which a British Museum specimen has been chosen. The history of Day's fish collections is briefly outlined; the Calcutta specimens are considered to be the most important, followed by those in Sydney, Vienna, Leiden, Berlin, Florence and Chicago. Apart from some small collections prior to 1870, the British Museum received only the remainders (in 1889).

INTRODUCTION

Francis Day (1829–1889) listed 55 clupeoid species in his *Fishes of India* (1875–8), of which 47 were illustrated, and 46 species are here recognized as valid (Table 1). He described six new species of clupeoid fishes, of which all but one are valid. Day's descriptions and figures are generally good but many diagnostic features essential to modern clupeoid systematics are omitted. Unfortunately, Day did not specify which specimens were used in his original descriptions and a major problem has been to decide in which institution his types are deposited. The full history of Day's collections is complex and will be described elsewhere (Whitehead & Talwar, in preparation) but a brief resumé can be given here.

Day's first ichthyological work, the *Fishes of Malabar* (1865) resulted from his stay in Cochin (1859–64) and from this time stemmed small collections sent to Albert Günther at the British Museum. Day subsequently investigated the fisheries in almost every large river and along most of the coast of India and Burma, making large collections and finally returning to England in 1874 to work on his specimens and write his monumental *Fishes of India* (1875–1888). Unfortunately, a series of bitter quarrels developed between Day and Günther, with the result that Day donated or sold much of his collection to other museums, the British Museum once again receiving material only in the year of Day's death. The following is a summary of the distribution of Day's specimens:

1864–1870	British Museum (15 lots, c. 400 specimens. Day types specified in letters but not in Register)
1865	East India Museum, London (7 species, including *Engraulis auratus*)

1875–1879	Rijksmuseum van Natuurlijke Historie, Leiden (11 lots, c. 500 specimens. Day types claimed in Register)
1876–7	Indian Museum, Calcutta (figured specimens, now in Zoological Survey of India)
1874–1882	Zoologisches Museum, Berlin (many lots, 296 specimens. Day types claimed in Register)
1881–1884	Florence (three lots, 333 specimens, 3 types claimed in Register)
1883	Australian Museum, Sydney (Day collection from International Fisheries Exhibition, London. Day, Bleeker and Blyth types claimed by Whitley, 1958)
1886	Naturhistorisches Museum, Vienna (1000 specimens, 815 species—Day and Bleeker types claimed in Annual Report)
1889	British Museum (c. 5,000 specimens. Day types subsequently recognized); also Leningrad (see p. 85)
1899	Field Museum of Natural History, Chicago (452 Day specimens from British Museum sent in exchange by Boulenger)

The Calcutta specimens include those used by Day in illustrating the *Fishes of India* (specified as such in Registration Book) and these are being listed by Talwar & Chakrapany (in press). We have concluded that, unless a valid lectotype has been chosen already, the figured Calcutta specimens are the most suitable. In his final letter of reconciliation to Günther, Day specified that his type collection of Indian fishes went to Calcutta, his No. 2 to Sydney, No. 3 to Vienna, while Florence, Berlin and Leiden had large numbers of specimens. Thus the British Museum received his remainders, except for types in the pre-1870 lots. This order should be followed in making a lectotype selection.

In the descriptions given here, measurements follow those of previous clupeoid studies (e.g. Whitehead, Boeseman & Wheeler, 1966). Synonomies include references based on Day material or those relevant to the discussion of Day's species. All further synonyms are given by Whitehead (in press). The following abbreviations are used:

AMS	Australian Museum, Sydney
BMNH	British Museum (Natural History), London
FMNH	Field Museum of Natural History, Chicago
MNHN	Muséum National d'Histoire Naturelle, Paris
NHMV	Naturhistorisches Museum, Vienna
RMNH	Rijksmuseum van Natuurlijke Historie, Leiden
ZMB	Zoologisches Museum, Berlin
ZSI	Zoological Survey of India, Calcutta

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Family **CLUPEIDAE**

(Subfamily **CLUPEINAE**)

1. ***Clupea sindensis*** Day, 1878

= ***Sardinella sindensis*** (Day, 1878)

(Plate 1a)

Clupea sindensis Day, 1878, *The Fishes of India*: 638, pl. 163 (2) (Seychelles, Sind, Bombay; figure (life-size) on Karachi specimen, shown 95·5 mm S.L.); *Idem*, 1889, *Fauna British India, Fishes*, **1** : 374 (repeat).

Sardinella sindensis: Chan, 1965, *Jap. J. Ichthyol.*, **13** (1–3) : 11, fig. 21 (key, 44 specimens *ex* Philippines); Whitehead (in press), *Symp. Indian Ocean Adj. Seas. Mar. biol. Ass. India* (key, synopsis, fig.).

MATERIAL.

a. ZSI.2630, a fish 95·5 mm S.L., *ex* Karachi (stated to be basis for Day's figure—LECTOTYPE)
b. ZSI.2614, a fish 90·0 mm S.L., *ex* Karachi (PARALECTOTYPE)
c. AMS.B7642, a fish 118·5 mm S.L. (140·5 mm tot. l.), *ex* Bombay (claimed as type by Whitley, 1958—? PARALECTOTYPE)
d. NHMV (no specimens)
e. RMNH (no specimens)
f. ZMB (no specimens)
g. BMNH.1889.2.1.1919–24, five fishes 77·5–99·5 mm S.L., *ex* Sind (registered as *Clupea venenosa;* one specimen, a skeleton)

Whitley (1958) gave wholesale endorsement to the type designations made in the published list of Day material bought by the Australian Museum in 1883 (Anon., 1885, 1886). This material, which had been shown at the International Fisheries Exhibition in London in 1883, had already been catalogued (Day, 1883) and, although some specimens were marked as the types of Bleeker and Blyth species, none was indicated as a Day type. Day appears to have described the present species on more than one specimen and while the Sydney specimen may be part of the syntypical series, we feel it preferable to designate as lectotype the one specimen that definitely contributed to the original description, *viz.* the Calcutta figured specimen, particularly since Day himself drew the figure.

Day (1878, 1889) tentatively included *Meletta venenosa* Valenciennes in his synonymy, hence the inclusion of the Seychelles in his distribution of the species. The Valenciennes species is *Herklotsichthys punctatus* (Rüppell) (Whitehead, 1967 :

35). The British Museum specimens were not relabelled '*sindensis*' until examined by Regan (1917a); it is unlikely, therefore, that they were used by Day in his description.

Description. Based on the LECTOTYPE, a fish 95·5 mm S.L., *ex* Karachi, ZSI.2630 (basis for pl. 163 (2) of *Fishes of India*) (in parenthesis are given measurements for the Calcutta PARALECTOTYPE, ZSI.2614).

Br. St. 6, D iii 13 (14), P i 14, V i 7, A ii 16, g.r. 36 + 65 (37 + 63), scutes 18 + 14, scales in lateral series 42 (43), transverse 11, pre-dorsal 15 (?).

In percentages of standard length: body depth 25·7 (23·9), head length 26·7 (22·5); snout length 6·5 (6·9), eye diameter 6·3 (6·9), upper jaw length 9·9 (10·6), lower jaw length 12·0 (10·6); pectoral fin length 16·2 (15·0), pelvic fin length 9·9 (8·1), length of anal fin base 15·7 (14·5); pre-dorsal distance 46·1 (43·3), pre-pelvic distance 48·2 (48·9), pre-anal distance 76·4 (77·8).

Body fairly compressed, its width about $2\frac{1}{2}$ times in its depth, the latter more or less equal to head length; belly keeled, scutes partly concealed by scales on either side. Snout equal to or a little greater than eye diameter. Upper jaw reaching to vertical from anterior third of eye; two supra-maxillae, the 1st (anterior) about 5 times as long as deep, the 2nd (posterior) with upper and lower expanded parts similar in shape and size, the whole almost circular; no hypomaxilla; expanded portion of maxilla with faint longitudinal ridges, lower edge of maxilla with fine denticulations posteriorly. Lower jaw profile rising steeply, its depth half its length. Pre-maxillae and vomer edentulous, but fine teeth on either side of dentary symphysis, a median line of conical teeth on tongue and fine teeth on palatines and ecto- and endo-pterygoids.

Gillrakers fine and slender, close-set, the longest about $\frac{1}{2}$ of eye diameter and equal to length of corresponding gill filaments. Pseudobranch present, exposed, with a dozen filaments, its length about equal to eye diameter. Cleithral lobe and bilobed dermal outgrowths from cleithrum well developed. Operculum about twice as high as wide, its lower margin almost horizontal; sub-operculum rectangular. Opercular series and cheek covered by adipose tissue overlying ramifications of sensory canal system. Fronto-parietal region with cuneiform area bearing 8 (9) longitudinal striae; supra-orbitals with about four longitudinal striae.

Dorsal fin origin much nearer to snout than to caudal base; lower part of fin invested in scaly sheath. Pectoral fin tips failing to reach pelvic base by more than one eye diameter, failing to reach vertical from dorsal origin by $1\frac{1}{3}$ eye diameters; no axillary scale but scales above first ray truncated to leave shallow depression for reception of fin. Pelvic fin base below middle of dorsal base, nearer to pectoral base than to anal origin; axillary scale present, almost length of fin. Anal fin slightly nearer to caudal base than to pelvic base; last two rays enlarged, about twice length of antepenultimate ray.

Scales: unexposed portion of scale with one major and four (anterior scales) to six (posterior) minor vertical striae, the former continuous, the latter interrupted at centre of scale; exposed portion of scales with eroded and slightly crenellated posterior border, faint horizontal ridging and small perforations. Pre-dorsal

medial ridge covered by overlapping scale rows on either side. Alar scales absent (probably lost; present in some specimens of BMNH.1889.2.1.1919–24).

Colour: in alcohol, upper ⅓ of body slate-coloured, remainder of flanks silvery-gold. Fins hyaline, but dark spot at base of anterior dorsal rays. Inside face of operculum somewhat dusky.

NOTE. *Sardinella sindensis*, together with *S. gibbosa* (Bleeker), can be separated from other species of *Sardinella* by its slightly higher post-pelvic scute count (15–16, rarely 14 or 17–18; cf. 12–14, rarely 11 or 15—see key in Whitehead, in press). This slight distinction held true in 44 and 159 specimens (respectively) examined by Chan (1965), and also in British Museum material, and it is unfortunate that both lectotype and paralectotype of *S. sindensis* have the lower count of 14. One out of five other Day specimens (BMNH.1889.2.1.1919–24) has 14 post-pelvic scutes. If scute number is diagnostic, then *S. sindensis* can be separated from *S. gibbosa* by its slightly higher range for gillraker numbers (58–72 at 69–122 mm S.L.; cf. 43–63 at 90–150 mm S.L.—figures from Whitehead, in press). Specimens with only 14 post-pelvic scutes can be distinguished from *S. albella* (Valenciennes) and *S. fimbriata* (Valenciennes) by their more slender body (24·5–27·8% of S.L. (Chan, 1965); cf. 32–35 and 28–34% respectively—Whitehead, in press). *Sardinella brachysoma* Bleeker and *S. zunasi* (Bleeker) are also slightly deeper species which are further distinguished by the numerous overlapping or continuous vertical striae on the posterior scales.

(Subfamily **PELLONULINAE**)

DAYELLA gen. nov.

TYPE SPECIES: *Spratelloides malabaricus* Day.

DIAGNOSIS: clupeid fishes with 5–6 branchiostegal rays, a short anal fin (less than 20 rays), small unkeeled pre-pelvic scutes but no post-pelvic scutes, eight pelvic rays, a single (posterior) supra-maxilla, gillrakers present on posterior face of 3rd epibranchial, and posterior frontal fontanelles occluded in adults. A single species known.

2. ***Spratelloides malabaricus*** Day, 1873

= ***Dayella malabarica*** (Day, 1873)

Spratelloides malabaricus Day, 1873, *Proc. zool. Soc. Lond.*: 240 ('Sea, ascending rivers in Malabar, and attaining 3 inches in length'); *Idem*, 1878, *Fishes of India*: 648, pl. 161 (5) ('Western Coasts of India, in rivers and estuaries'; up to 3 inches, figure (? life size) 55·3 mm S.L.); *Idem*, 1889, *Fauna British India, Fishes*, **1** : 400, fig. 124 (repeat).

MATERIAL.

a. ZSI.2246, a fish 51·0 mm S.L., *ex* Malabar (stated to be basis for Day's figure although 4·3 mm shorter—LECTOTYPE)
b. RMNH.2726, a fish 58 mm S.L., *ex* Malabar—PARALECTOTYPE

c. BMNH.1889.2.1.2048, a fish 47·3 mm S.L., *ex* Malabar, stained with alizarin —PARALECTOTYPE
d. Zool. Inst. Leningrad, 8220, a fish 48·3 mm S.L., *ex* Canara —PARALECTOTYPE

The following specimens are *Ehirava fluviatilis*.

e. AMS.B8288, a fish 44·0 mm S.L. (52·0 mm tot. l.), *ex* Malabar (claimed as type by Whitley, 1958)
f. NMV (no specimens)
g. ZMB.10413, three fishes 28·9–35·4 mm S.L., *ex* Malabar.
h. BMNH.1889.2.1.2051, two fishes 40·0–49·1 mm S.L., *ex* Malabar (removed from jar containing BMNH. paralectotype)
i. BMNH.1889.2.1.2050, one fish 53·0 mm S.L., *ex* Malabar (also removed from BMNH paralectotype jar)
j. BMNH.1889.2.1.2052–5, four fishes 46·5–56·2 mm S.L., *ex* Canara (one fish 50·0 mm stained with alizarin; three fishes donated to the Musée Royale de l'Afrique Centrale, Turvuren)
k. FMNH.2379, a fish 49·0 mm S.L., *ex* Canara (numbered 240 and donated by G.A. Boulenger from BMNH collection)

The two species included in the Day material are superficially very similar and hitherto Deraniyagala's *fluviatilis* has been considered a synonym of Day's *malabaricus* (e.g. in Whitehead, 1963). It was not until the single true specimen of *Dayella malabarica* in the British Museum was stained with alizarin and re-examined that the Day material was found to be mixed. Although specimens of *E. fluviatilis* predominate, Day's original description seems to have been based on *D. malabarica* since Day states that the 'dorsal commences slightly before the origin of the ventral'. In *D. malabarica* the dorsal origin is well before the pelvic base, the latter lying below the first *branched* dorsal ray. In *E. fluviatilis* the pelvic base is before, below or only just behind the first *unbranched* dorsal ray. The statement is repeated in Day's second description and in his figure (Day, 1878 : pl. 161) the dorsal origin is clearly well before the pelvic base.

The specimen in Calcutta is slightly smaller than Day's figure but is presumed to have been the model and is here chosen as lectotype of *Spratelloides malabaricus*. The holotype of *Ehirava fluviatilis* Deraniyagala is in London (BMNH.1929.7.1.1); the specimen in the Zoological Survey of India (ZSI.F11043/1), claimed as a paratype by Menon & Yazdani (1963), is from Moratua (Western Province of Ceylon), a locality not mentioned in the original description.

Description. Based on the LECTOTYPE, a fish 51·0 mm S.L., *ex* Malabar, ZSI.2246 (basis for pl. 161 (5) of *Fishes of India*). Figures for the Leiden and British Museum specimens (49·5 and 47·3 mm S.L.—lots b and c above) are given in parenthesis.

Br. St. 6 (5, 5), D iii 11 (11, 11), P i 12 (12, 13), V i 7 (7, 7), A iii 15 (14, 15), C n.r. (n.r., 10 + 9), g.r. 11 + 27 (10 + 24, 10 + 27), scutes ? 0 (4, 1), scales in lateral series 38 (n.r., 36), transverse 9 (n.r., n.r.), vertebrae 40 (BMNH alizarin specimen).

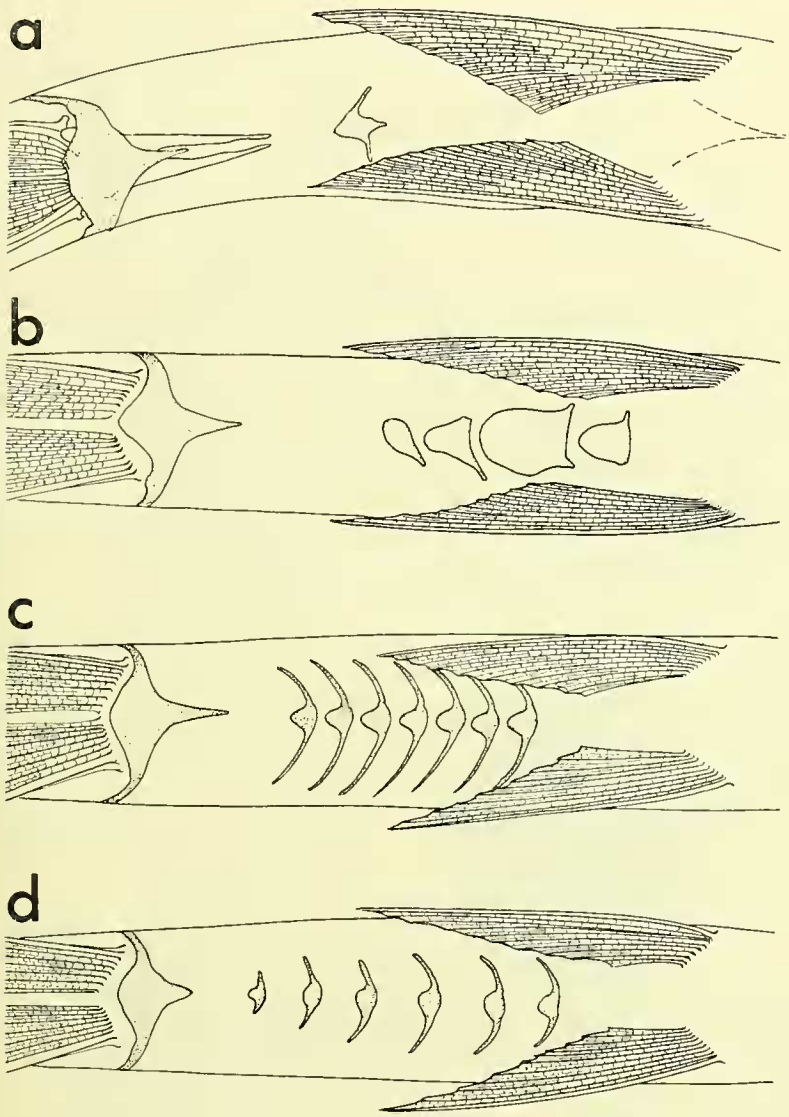

FIG. 1. Pre-pelvic scutes in three Indo-Pacific pellonulines. a. *Dayella malabarica*, 47·3 mm S.L., BMNH.1889.2.1.2048. b. *Dayella malabarica*, 49·5 mm S.L., RMNH.8585. c. *Gilchristella aestuarius*, 52·3 mm S.L., BMNH.1915.7.6.3. d. *Ehirava fluviatilis*, 49·1 mm S.L., BMNH.1889.2.1.2051.

In percentages of standard length: body depth 22·5 (20·0, 20·0), head length 27·7 (24·0, 26·0); snout length 8·3 (7·5, 7·4), eye diameter 8·3 (8·0, 7·8), post-orbital distance 9·9 (8·5, 8·7), length of upper jaw 9·9 (8·7, 9·7), length of lower jaw 14·7 (12·3, 13·1); pectoral fin length 16·7 (17·1, 15·8), pelvic fin length 13·7 (13·3, 14·5), length of anal base 18·6 (15·3, 14·5); pre-dorsal distance 49·0 (47·9, 48·5), pre-pelvic distance 52·9 (50·4, 49·5), pre-anal distance 78·4 (77·3, 75·0).

Body fairly compressed, its width almost 3 times in its depth, the latter a little less than head length; belly rounded, fully scaled but the scales underlain by 4 (Leiden) or 1 (BMNH) plate-like scutes bearing rudimentary lateral arms (fig. 1a, b), the scutes not reaching back to the main pelvic scute (which has normal lateral arms). Snout equal to or a little shorter than eye diameter. Jaws unequal, the lower projecting slightly. Upper jaw reaching to vertical from anterior eye border or anterior pupil margin, ventral expanded portion of maxilla beginning abruptly and not tapered smoothly into slender anterior limb of bone, the entire edge of the expanded portion finely denticulated (fig. 2); a single (posterior) supra-maxilla, the lower part of the expanded portion deeper and longer than the upper part (*Harengula* shape), its depth about $\frac{1}{2}$ eye diameter. Lower jaw rising fairly steeply in the first third of its length; 6–7 small conical teeth on either side of symphysis. A single row of small conical teeth on pre-maxillae, separated by a median diastema. Fine teeth on tongue, scattered on antero-median process of palatine and along outer edge of that bone.

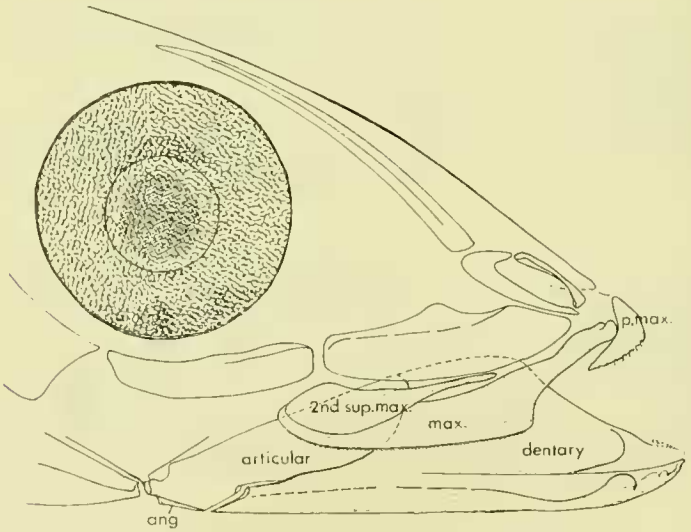

FIG. 2. *Dayella malabarica*, upper and lower jaws, alizarin stained specimen, 47·3 mm S.L., BMNH.1889.2.1.2048.

Gillrakers fine, slender, 2½ times in eye diameter and a little longer than corresponding gill filaments; about 7 short, stumpy gillrakers on posterior face of 3rd epibranchial. Pseudobranch present, exposed, about ½ eye diameter, with about a dozen filaments. Cleithral lobe present at lower angle of gill opening, fairly well developed. Operculum about 1½ times as deep as broad, its posterior margin with a deep indentation, its lower margin rising at an angle of about 15° to the horizontal; suboperculum rectangular except for rounding of postero-ventral angle. Cutaneous sensory canals branching over entire opercular series and cheek. Frontoparietal rea smooth, posterior frontal fontanelles retained and minute, 1·0 mm in length (0a·5 mm in BMNH specimen—fig. 3c; virtually occluded in Leiden specimen).

Dorsal fin origin nearer to snout tip than to caudal base by ¾ eye diameter and a little in advance of vertical from pelvic base. Pectoral fin tips failing to reach pelvic base by 1 (1½) eye diameters; no axillary scale. Pelvic fin base below first branched dorsal ray and about equidistant between pectoral base and anal origin; axillary scale present, about ⅓ of fin length (Leiden specimens). Anal fin origin a little nearer to caudal base than to pelvic base; last two rays normal, not separated from rest of fin.

Scales: deeper than broad, with distinct anterior 'shoulders'; unexposed portion with a single continuous striation, preceded by 3–4 short radiating striae (absent on anterior scales, joined to form a loop on some posterior scales); exposed portion of scale without striae, its posterior margin slightly eroded and produced medially.

Colour: in alcohol, uniform light brown with a faint silvery midlateral stripe not quite as broad as eye; fins hyaline.

NOTE. The new genus *Dayella* is a member of the pellonuline complex that comprises the monotypic Indo-Pacific genera *Ehirava, Gilchristella, Sauvagella* and *Spratellomorpha.* These five genera are distinguished from all other Indo-Pacific pellonulines by their lack of post-pelvic scutes; in addition, pre-pelvic scutes are either absent or extremely poorly developed. The separation of the five species at generic level is arguable but the features that distinguish them are non-meristic and appear to be of some significance in other groups of clupeids. *Dayella* can be identified from the following key.

INDO-PACIFIC PELLONULINAE THAT LACK POST-PELVIC SCUTES

I. Anal fin entire, last two rays not separate

A. Gillrakers present on posterior face of 3rd epibranchial

1. Posterior frontal fontanelles minute (⅕ eye diameter) or completely occluded in adults (fig. 3c); pre-pelvic scutes 1–4, rudimentary, lateral arms barely developed (fig. 1a, b); pelvic base well behind dorsal origin; gillrakers 24–27

Dayella malabarica (Day)

2. Posterior frontal fontanelles larger (⅓–½ eye diameter), retained in adults (fig. 3a, b); pelvic base before dorsal origin

a. No pre-pelvic scutes; gillrakers 19 (at 40 mm S.L.)

Sauvagella madagascariensis (Sauvage)

b. Up to 9 pre-pelvic scutes, with thin lateral arms

i. Anterior arm of supra-occipital broadening anteriorly (fig. 3b); gillrakers 39–45

Gilchristella aestuarius (Gilchrist)

ii. Anterior arm of supra-occipital very slender anteriorly (fig. 3a); gillrakers 40–60

Gilchristella sp. (see below)

B. Gillrakers absent on posterior face of 3rd epibranchial; posterior frontal fontanelles large, anterior arm of supra-occipital broadening anteriorly (fig. 3d); pre-pelvic scutes present, poorly developed but with distinct lateral arms (fig. 1d); pelvic base below or before dorsal origin; gillrakers 26–30 . . . . . ***Ehirava fluviatilis*** Deraniyagala

II. Anal fin split, the last two rays separate from rest of fin; gillrakers present on posterior face of 3rd epibranchial; posterior frontal fontanelles large, probably retained in adults, similar to those of *Ehirava*; gillrakers 26–31

Spratellomorpha bianalis (Bertin)

The four previously described Indo-Pacific genera were formerly placed in the round herrings or Dussumieriidae (Whitehead, 1963). The subsequent discovery of partially scuted (*Laeviscutella*, *Sierrathrissa*) or non-scuted (*Congothrissa*) forms amongst the otherwise fully scuted West African Pellonulinae suggested that both Indo-Pacific and African genera were members of a clupeid group that showed progressive stages in scute loss. This appeared to be correlated with trends towards reduction in supra-maxillae and numbers of branchiostegal rays, together with a retention of the posterior frontal fontanelles by adults (Poll, Whitehead & Hopson, 1965). The non-scuted genera *Spratelloides* (Indo-Pacific) and *Jenkinsia* (Western Atlantic) may eventually join this group, although their very characteristic W-shaped pelvic scute seems to link them with the 'true' round herrings *Dussumieria* and *Etrumeus*—whose high and presumably primitive branchiostegal count implies yet another route to scute loss (or perhaps the primitive absence of scutes, at least in this branch of the clupeids). For the present, the five poorly or non-scuted genera shown in the key above are placed in the tribe Ehiravini of the subfamily Pellonulinae.

In *Dayella*, the scutes are more rudimentary than in any other clupeid genus. They are thin, difficult to find in unstained material and those with small lateral arms could easily be mistaken for scales. Their resemblance to scales is increased by the relatively large size of the expanded portion of the scute when compared with those of other genera (fig. 1a–d). The variation in shape of these scutes implies that these are structures on the way to being lost and not an early stage in the evolution of scutes.

Dayella appears to be most closely allied to *Gilchristella*, *Sauvagella* and *Ehirava*, differing from them chiefly in its occluded posterior frontal fontanelles and its less advanced pelvic base. The absence of gillrakers on the posterior face of the 3rd epibranchial seems to hold some significance elsewhere in the Clupeidae, but this

may not mean that *Ehirava* is necessarily remote from the other genera of the group. The status of *Sauvagella madagascariensis* is uncertain. Re-examination of a syntype of this species (40 mm S.L., MNHN.3794) has confirmed that even the rudimentary scutes of *Dayella* are not present. This fish has only 19 gillrakers and the posterior frontal fontanelles are large, suggesting that it is a juvenile; gillrakers may increase with size. In a redescription of the species (Whitehead, 1963), eleven South African specimens were included, from the Buffalo river, Cape Province (BMNH.1878.1.22.25 and 33–43) and the stated gillraker count of 40–56 referred to these specimens only. Careful removal of the belly scales now shows that these fishes have up to 7 thin and barely apparent scutes with fairly long lateral arms. Thus, they are clearly distinct from *Sauvagella* (as far as can be judged from the very small types) and for the moment they appear to be an undescribed species of *Gilchristella*. From *G. aestuarius* they differ, however, in having a very slender

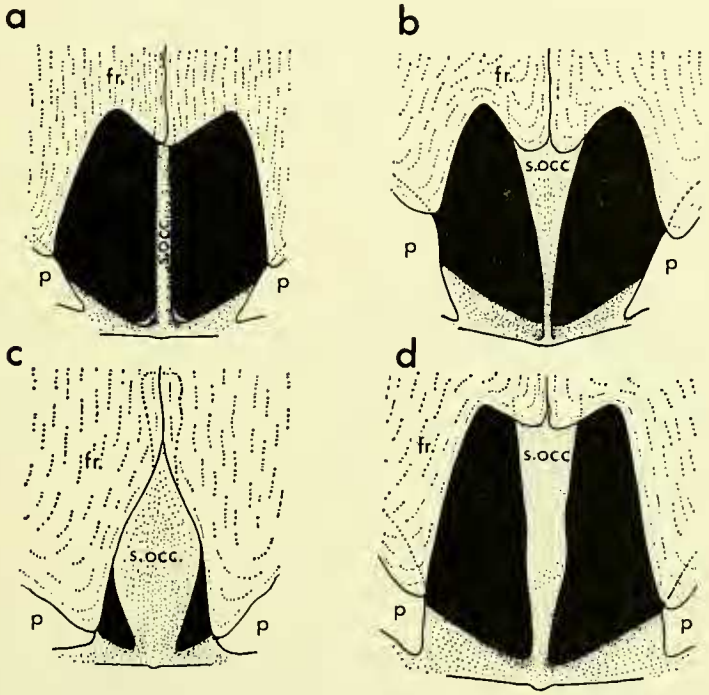

FIG. 3. Posterior frontal fontanelles in four Indo-Pacific pellonulines, dorsal view showing frontals (fr.), parietals (p.) and anterior arm of supra-occipital (s. occ.), the fontanelles black. a. *Gilchristella* sp., 52·6 mm S.L., anomalous Buffalo River specimen, BMNH.1878.1.22.25. b. *Gilchristella aestuarius*, 54·5 mm S.L., BMNH.1919.9.12.3. c. *Dayella malabarica*, 47·3 mm S.L., BMNH.1889.2.1.2048. d. *Ehirava fluviatilis*, 50·0 mm S.L., BMNH.1889.2.1.2052.

anterior arm of the supra-occipital (fig. 3a) and a higher gillraker count (40–60 cf. 39–45). In general, the members of the *Ehirava* complex are rather poorly known and would repay further study when more specimens are available.

(Subfamily ***ALOSINAE***)

3. ***Clupea variegata*** Day, 1869

= ***Gudusia variegata*** (Day, 1869)

(Plate 1c)

Clupea variegata Day, 1869, *Proc. zool. Soc. Lond.*: 623 (Irrawaddy and its branches; many specimens, to 7 inches); *Idem*, 1878, *Fishes of India*: 639, pl. 161 (4) (repeat; figure of fish 152 mm S.L., presumably life-size); *Idem*, 1889, *Fauna British India, Fishes*, **1** : 375 (repeat).

Gudusia variegata: Regan, 1917, *Ann. Mag. nat. Hist.*, (8) **19** : 308 (on single Day specimen in British Museum); Motwani, Jayaram & Sehgal, 1962, *Trop. Ecol.*, **3** (1–2) : 17–43 (Brahmaputra at Jogighopa, Goalpara District); Whitehead, 1965, *Bull. Br. Mus. nat. Hist.* (Zool.), **12** (4) : 150, fig. 11 (Day specimen redescribed; Day's figure reproduced); *Idem*, (in press), *Symp. Indian Ocean Adj. Seas. Mar. biol. Ass. India* (key, note on synonymy).

? *Clupea suhia* Chaudhuri, 1912, *Rec. Indian Mus.*, **7** : 436, pl. 38 (1) (river Gandak in Saran, Bihar).

? *Gudusia godanahiai* Srivastava, 1968, *Fishes Eastern Uttar Pradesh*: 6, fig. 4a, b (Gorakhpur, Uttar Pradesh).

Material.

a. ZSI.2245, a fish 150·0 mm S.L., *ex* Irrawaddy river (stated to be basis for Day's figure—LECTOTYPE)
b. ZSI (Duplicate Cat.) 43, a fish 158 mm S.L., *ex* Bassein river (labelled *Clupea burmanica*)
c. ZSI. (Duplicate Cat.) 168, a fish 78 mm S.L., *ex* Mandalay, coll. Major E. B. Sladen (labelled *Clupea burmanica*)
d. AMS.B7676, a fish 158·5 mm S.L. (191 mm tot. l.), *ex* Bassein (claimed as type by Whitley, 1958.
e. NHMV (no specimens)
f. RMNH.2586, a fish 106·4 mm S.L., *ex* Bassein.
g. ZMB (no specimens)
h. BMNH.1870.6.14.38, a fish 155 mm S.L., *ex* Bassein.

For reasons given under the previous two species, the figured specimen in Calcutta is chosen as lectotype. The two specimens labelled '*burmanica*' are *G. variegata* but are probably not syntypes since their meristic counts exceed the values given in the original description (but are consistent with the ranges given in the *Fishes of India*). Day did not publish the name *burmanica* but may have initially intended to use it for this species. The British Museum specimen, although presented in 1870 and thus the first of this species to be given away by Day, has too low an anal and pectoral count (iii 22 and i 13; cf. iii 26 and i 15) to have figured in the original

description, which in any case seems to have been based on a single specimen (although many were taken). For this reason, the Sydney and Leiden specimens cannot be regarded as paralectotypes.

DESCRIPTION. Based on the LECTOTYPE, a fish 150·0 mm S.L., *ex* Irrawaddy river, ZSI.2245 (basis for pl. 161 (4) of *Fishes of India*).

Br. St. 6, D iii 12, P i 15, V i 7, A iii 26, g.r. 210 (approx.), scutes 19 + 11, scales in lateral series 90, transverse 35.

In percentages of standard length: body depth 44·3, head length 29·3; snout length 5·5, eye diameter 6·7, length of upper jaw 11·7, length of lower jaw 13·0, operculum height 14·3, its breadth 8·3; pectoral fin length 20·0, pelvic fin length 10·0, length of anal fin base 23·0; pre-dorsal distance 52·0, pre-pelvic distance 54·7, pre-anal distance 74·0.

Body strongly compressed, its width $3\frac{3}{5}$ times in its depth, the latter $1\frac{1}{2}$ times head length; belly keeled, tips of scutes projecting slightly from sheath of scales on either side. Snout shorter than eye diameter; pre-orbital distance (including eye) $\frac{3}{4}$ of post-orbital distance. Lower jaw included when mouth closed; pre-maxillae rising steeply to form very distinct notch in upper jaw. Maxilla reaching to just beyond vertical from eye centre, expanded portion without longitudinal ridges or striae and smooth along lower edge; two supra-maxillae, the 1st (anterior) about 6 times as long as deep and almost equal in length to eye diameter, the 2nd (posterior) with slender anterior shaft and lower part of expanded portion larger than upper. Lower jaw rising rather gently in the first third of its length, its depth about 3 times in its length; no teeth present. No teeth in upper jaw nor within mouth.

Gillrakers fine, straight or slightly curved, slightly longer than corresponding filaments; filaments of anterior hemibranch of 1st arch $\frac{1}{2}$–$\frac{3}{4}$ length of those of posterior hemibranch; many fine gillrakers present on posterior face of 3rd epibranchial. Medio-pharyngobranchial present, about $\frac{3}{4}$ eye diameter, bearing many short gillrakers. Pseudobranch present, attenuated, about $1\frac{4}{5}$ times eye diameter, with distinct ventral ridge and a groove below it. Cleithral lobe barely developed, hardly breaking outline of gill opening. Operculum not quite twice as deep as broad, its lower edge rising steeply; sub-operculum crescentic; lower third of anterior operculum margin not overlapped by pre-operculum, leaving a small triangular area covered only by skin. Cutaneous sensory canals branching through the adipose tissue covering the suborbitals, operculum, sub-operculum and scales behind head. Adipose eye-lid with vertical slit exposing $\frac{3}{4}$ of pupil. Dorsal surface of head covered by fairly thick skin but a pair of cuneiform fronto-parietal areas with about six longitudinal striae left exposed.

Dorsal fin origin slightly nearer to snout tip than to base of caudal; a very low scaly sheath along base. Pectoral fin tips failing to reach pelvic base by about $\frac{1}{2}$ eye diameter; axillary scale present, half length of fin. Pelvic fin base below vertical from dorsal origin and a little nearer to pectoral base than to anal origin; axillary scale present, half length of fin. Anal origin equidistant between pelvic and caudal bases; anal base longer than pectoral fins and greater than the distance

snout tip to posterior border of pre-operculum. Caudal fin (broken) slightly longer than head length, lower lobe longer than upper.

Scales: almost circular, but becoming more elongate on posterior part of body; a single vertical striation continuous across scale, preceded by 0 (anterior scales) to 3 (posterior scales) short and irregular striae interrupted at centre of scale; exposed border irregular, becoming pectinate in posterior scales. Minute scales covering caudal except for hind border.

Colour: in alcohol, back brown, flanks golden; a series of brown spots along upper flank, some expanded vertically, those behind dorsal extending right across back; a dark humeral spot.

NOTE. The genus *Gudusia* (often misspelt *Gadusia* in the literature) at present includes two species, *G. chapra* (Ham. Buch.) and *G. variegata*. The latter has a deeper body (depth greater than 40% of S.L.), a shorter head (head length less than 28% of S.L.), and more anal finrays (iii 22–26; cf. iii 19–22). In addition, *G. variegata* has a very prominent series of black spots along the flank, whereas *G. chapra* is usually described as having a dark shoulder spot, sometimes absent, and faint or no spots along the flank (Whitehead, 1965; Srivastava, 1968). Rather few specimens of *G. variegata* have been described, however, and some of these were misidentifications. Thus, specimens identified as *G. variegata* from Akyab by Lloyd (1907) include at least one fish (ZSI.1491/1) that is *Hilsa kelee*, while juveniles reported as *G. variegata* from the Mandalay fish market by Jenkins (1910) include specimens (ZSI.1770/1) of a species of *Hilsa* (*Tenualosa*).

Gudusia variegata is usually considered a Burmese species (Regan, 1917b; Fowler, 1941 : 635), but both Chandhuri's *Clupea suhia* and Srivastava's *Gudusia godanahiai* (Ganges drainage) had very prominent black spots along the flanks which were, indeed, the main reason for distinguishing these nominal species from the sympatric and unspotted *G. chapra* (not a sexual feature according to Srivastava, 1968). *Gudusia variegata* has also been reported from the Brahmaputra, by Motwani *et alii* (1962), presumably because of the strong pattern of spots since *G. chapra* was also recorded from the same area (no descriptions given, however). If these Indian records truly relate to *G. variegata*, then some modification must be made to the key since Srivastava's *G. godanahiai* were rather slender (depth 33·3–38·7% of S.L.) and thus within the range of *G. chapra* (31·0–40·0% in 30 specimens—Whitehead, 1965: fig. 13); the head length (27·4–31·7% of S.L.) of Srivastava's specimens, however, agreed with current definitions of *G. variegata*, but the low anal count of ii–iii 20 was that of *G. chapra*. Srivastava distinguished his new species by the presence of 14 pectoral rays (13 in his *G. chapra*), but Regan (1917b) recorded 13–14 pectoral rays in the British Museum material of *G. chapra* and there is probably overlap between the two species. For the present, the status of *G. variegata* and its possible synonyms must remain uncertain until more material has been examined.

(Subfamily ***DOROSOMATINAE***)

4. *Chatoessus modestus* Day, 1869

= *Gonialosa modesta* (Day, 1869)

Chatoessus modestus Day, 1869, *Proc. zool. Soc. Lond.*: 622 (Bassein river as high as Een-gay-gyee Lake; many specimens, up to 5½ inches); *Idem*, 1878, *Fishes of India*: 633, pl. 160 (1) (also Selwein at Moulmein; figure of fish 100·1 mm S.L., ? life size); *Idem*, 1889, *Fauna British India, Fishes*, **1** : 386 (repeat).

Gonialosa modesta: Regan, 1917, *Ann. Mag. nat. Hist.*, (8) **19** : 315 (on Day material in British Museum); Menon & Yazdani, 1963, *Rec. zool. Surv. India*, **61** : 98.

Material.

a. ZSI.2695, a fish 98·0 mm S.L., *ex* Bassein river (stated to be basis for Day's figure—LECTOTYPE)
b. ZSI.F8022/1 and 8023/1, two fishes 58·0–101·0 mm S.L., *ex* Bassein river (= *G. manminna*)
c. AMS.B7637, a fish 105·0 mm S.L. (127·5 mm tot. l.), *ex* Burma (claimed as type by Whitley)
d. NHMV (no specimens)
e. RMNH.2585, a fish 116·0 mm S.L., *ex* Moulmein (claimed as type in register)
f. ZMB (no specimens)
g. BMNH.1889.2.1.1879, a fish 82·6 mm S.L., *ex* Burma

Menon & Yazdani (1963) erroneously listed the first of the three Zoological Survey fishes as holotype, and the other two as paratypes, but Day did not indicate a holotype nor did he give an exact length measurement. The first Calcutta specimen, used for Day's figure, is here designated lectotype; the other two are *G. manminna* and thus do not agree with the original description, which in any case shows no ranges for meristic and morphometric values, suggesting that only a single fish was measured (although many were caught). For this reason, the Sydney, Leiden and London specimens are not regarded as paralectotypes.

Description. Based on the LECTOTYPE, a fish 98·0 mm S.L., *ex* Bassein river, ZSI.2695 (basis for pl. 160 (1) of *Fishes of India*).

Br. St. 6, D iii 13, P i 15, V i 7, A iii 25, g.r. 150 (approx.), scutes 17 + 12, scales in lateral series 47, transverse 17.

In percentages of standard length: body depth 48·5, head length 27·6; snout length 6·4, eye diameter 7·9, post-orbital distance 13·3, length of upper jaw 7·1, length of lower jaw 9·7; pectoral fin length 23·0, pelvic fin length 10·2, length of anal base 26·8; pre-dorsal distance 52·0, pre-pelvic distance 50·0, pre-anal distance 72·4.

Body compressed, its width $4\frac{7}{10}$ times in its depth, the latter almost twice head length; belly keeled, tips of scutes projecting below scaly sheath; profile of back concave beyond nape, rising abruptly to dorsal origin, belly profile evenly convex. Snout shorter than eye diameter. Mouth sub-terminal, transverse, with snout projecting strongly; pre-maxillae meeting at an angle to form a distinct notch in

upper jaw. Maxilla slender, slightly expanded and curved downwards distally, reaching to vertical from anterior border of eye; a single narrow supra-maxilla, its length 2·5 mm and depth 0·5 mm. Lower jaw with dentaries meeting at an obtuse angle, the edge of each dentary flared or reflected outwards in front of tips of maxillae. No teeth in jaws.

Gillrakers very fine, close-set, shorter than corresponding gill filaments and slightly more than $\frac{1}{3}$ eye diameter; gill filaments of anterior hemibranch equal to those of posterior hemibranch. Numerous fine and close-set gillrakers on posterior face of 3rd epibranchial. Pseudobranch present, exposed, its length almost one eye diameter; about 20 filaments present. Cleithral lobe present, breaking outline of gill opening but not strongly developed. Operculum $1\frac{1}{2}$ times as deep as broad, its lower border rising steeply (about 40°); suboperculum long and narrow, its posterior border rounded. Cutaneous sensory canals branching over cheek, opercular series and nape. Adipose eye-lid with vertical slit exposing $\frac{1}{3}$ of eye. Dorsal surface of head with a pair of cuneiform fronto-parietal areas bearing 6 longitudinal striae, the two areas linked posteriorly by a transverse bony ridge.

Dorsal fin origin slightly nearer to snout than to base of caudal fin; final finray not elongated. Pectoral fin tips reaching to beyond pelvic base; axillary scale present, $\frac{1}{4}$ length of fin. Pelvic fin base in front of dorsal origin and nearer to pectoral base than to anal origin; axillary scale present, $\frac{1}{3}$ length of fin. Anal origin nearer to pelvic than to caudal base. Lower lobe of caudal larger than upper.

Scales: unexposed portion with one major vertical striation and 3 (anterior scales) to 4–5 (posterior) minor vertical striae interrupted at scale centre. Exposed portion without striae, posterior margin of scale not eroded, perforated or fimbriated.

Colour: in alcohol, upper parts of body light brown, lower parts silvery; a dark humeral spot present. Fins hyaline.

NOTE. The two species of *Gonialosa*, *G. modesta* and *G. manminna* (Ham. Buch.), have been separated on body depth (40–50% of S.L. in *modesta*; 30–39% in *manminna*) and number of scales along the flank (45–47 and 55–65 respectively—Whitehead, 1962; in press). *Gudusia manminna* (from the Ganges and Brahmaputra and their tributaries) is fairly well represented in collections and the literature, but *G. modesta* (recorded only from Burma) is not. Larger collections may show *modesta* to be merely a subspecies of *G. manminna*.

(Subfamily ***PRISTIGASTERINAE***)

5. ***Pellona sladeni*** Day, 1869

= ***Ilisha sladeni*** (Day, 1869)

Pellona sladeni Day, 1869, *Proc. zool. Soc. Lond.*: 623 (Irrawaddy at Mandalay; specimens up to 7 inches); *Idem*, 1878, *Fishes of India*: 645, pl. 164 (1) (repeat; 'A single example obtained, 7 inches in length'; figure shows fish of 146 mm S.L.); *Idem*, 1889, *Fauna British India, Fishes*, **1** : 383 (repeat).

Ilisha sladeni: Norman, 1923, *Ann. Mag. nat. Hist.*, (9), **11** : 6 (Day specimen and two others described).

MATERIAL.

a. ZSI.2672, a fish 210 mm S.L. (ca. 10 inches tot. l.), *ex* Irrawaddy (stated to be basis for Day's figure—LECTOTYPE)
b. ZSI (Duplicate Cat.) 298, a fish 189 mm S.L. (ca. 8½ inches tot. l.), *ex* Mandalay (? PARALECTOTYPE)
c. AMS (no specimens)
d. NHMV (no specimens)
e. RMNH (no specimens)
f. ZMB (no specimens)
g. BMNH.1870.6.14.36, a fish 209 mm S.L. (almost 10 inches tot. l.), *ex* Mandalay.

As in previous cases, Day clearly collected more than one specimen, but he gave no ranges for meristic or morphometric values in his original description. In the *Fishes of India*, however, he stated 'single example obtained'; he may perhaps have been referring to the fish that he himself had drawn for the *Fishes of India*, since it was now eight years since he had given his other specimen to the British Museum. All three extant specimens are larger than either the figure or the maximum length stated (7 inches). They also differ in having more pre-pelvic scutes (23 or 24; cf. 20) and more pectoral rays (14 or 15; cf. 11). Day altered his scute count to 23 in the *Fishes of India* (but not the pectoral count) and it must be presumed that the earlier counts were errors. The larger Calcutta fish, the figured specimen, is chosen as lectotype, on the assumption either that Day lost the original (smaller) specimen or that the maximum length of 7 inches was also an error.

DESCRIPTION. Based on the LECTOTYPE, a fish 210 mm S.L., *ex* Irrawaddy river, ZSI.2672 (basis for pl. 164 (1) of *Fishes of India*) (measurements of ZSI paralectotype given in parenthesis).

Br. St. 6, D iii 10, P i 13, V i 6, A iii 41, g.r. 10 + 1 + 21, scutes 23 + 10, scales in lateral series 48, transverse 10.

In percentages of standard length: body depth 21·9 (25·4), head length, 24·5 (27·5); snout length 5·5 (5·8), eye diameter 6·0 (6·6), length of upper jaw 11·0 (11·9), length of lower jaw 11·4 (13·0); pectoral fin length 19·8 (21·7), pelvic fin length 4·8 (6·6), length of anal fin base 30·0 (29·4); pre-dorsal distance 59·1 (59·3), pre-pelvic distance 39·1 (44·0), pre-anal distance 65·2 (67·2).

Body strongly compressed, its width 4 times in its depth, belly strongly keeled, the tips of the scutes projecting below scaly sheath, especially behind pelvic fin base; anterior four scutes on isthmus. Dorsal profile slightly concave before nape, ventral profile evenly convex, the two almost parallel between pectoral base and dorsal origin. Snout a little shorter than eye diameter. Lower jaw strongly projecting, about ½ eye diameter beyond snout when mouth closed. Maxilla reaching to vertical from anterior pupil border, fine denticulations along its lower edge; no hypo-maxilla; two supra-maxillae, the 1st (anterior) 5 times longer than deep and about 1½ eye diameter, the 2nd (posterior) with lower lobe of expanded portion much larger than upper. A single series of fine teeth on pre-maxillae, with median diastema, small conical teeth present on either side of dentary symphysis. No teeth on vomer but fine teeth on tongue, palatines and ecto- and endo-pterygoids.

Gillrakers fairly slender, the longest $\frac{1}{2}$ eye diameter and $1\frac{1}{2}$ times length of corresponding gill filaments; no gillrakers on posterior face of 3rd epibranchial. Pseudobranch present, exposed, its length $\frac{1}{2}$ eye diameter; ventral margin not ridged. No cleithral lobe. Operculum elongated posteriorly, its ventral margin equal to its height and rising at an angle of about 20°; sub-operculum eliptical, long and narrow, its height $3\frac{7}{10}$ times in its width; lower border of sub-operculum and hind border of inter-operculum almost parallel to upper profile of head, to leave a broad triangular area below (bounded posteriorly by base of pectoral fin). Dorsal surface of head with two prominent longitudinal striae, diverging slightly posteriorly, flanked by two small lateral striae over eyes.

Dorsal fin origin set far back on body, equidistant between caudal base and posterior margin of operculum. Pectoral fin tips reaching almost to tips of pelvics; axillary scale present, $\frac{1}{3}$ length of fin. Pelvic base nearer to pectoral base than to anal origin by 2 eye diameters; axillary scale present, about $\frac{1}{3}$ length of fin. Anal fin origin below vertical from anterior third of dorsal base; base of fin covered by low scaly sheath.

Scales: unexposed portion with a single complete W-shaped vertical striation, preceded by 3 (anterior scales) to 6 (posterior) shorter striae interrupted at centre of scale; exposed portion with about 16 very short radiating striae at edge of scale, not discernible in posterior scales.

Colour: in alcohol, upper $\frac{1}{3}$ of body brown, rest of flanks silvery; fins hyaline, hind margin of caudal dusky. Inner face of operculum slightly dusky.

NOTE. *Ilisha sladeni* closely resembles *I. pristigastroides* (Bleeker), with which it has been synonymized (Whitehead, 1970), but comparison of Day's material with Bleeker's type in the British Museum (1867.11.28.12—redescribed in Whitehead *et alii*, 1966) suggests that I. *sladeni* is distinct. In both species the anal origin is well before the vertical from the midpoint of the dorsal base, a feature used in keys to separate these species from all other *Ilisha* (Whitehead *et alii*, *loc. cit.*; Whitehead, 1970). The type of *I. pristigastroides* is a smaller fish (151 mm S.L.; cf. 189–210 mm in the Day material), but this does not account for its deeper body (30·8% of S.L.; cf. 21·9, 25·4 and 22·4% in the Day material) since a larger Bleeker specimen (302 mm S.L., BMNH.1867.11.28.9) is still deeper-bodied (30·9% of S.L.) than a similar large specimen of *I. sladeni* (25·9% in a fish of 308 mm S.L., *ex* Sittang river, Burma, BMNH.1891.11.30.402). The Bleeker type also has a relatively longer anal base (41·1% of S.L.; cf. 30·0, 29·4 and 30·8%), the anal origin being set further back on the body (equidistant between caudal base and eye centre; cf. nearer to caudal base than to pectoral base), and the dorsal origin is also correspondingly less far back on the body. In spite of the more compact body in *I. pristigastroides*, there are more pre-pelvic scutes (26) than in the elongate *I. sladeni* (23–24). All these features also serve to separate the two larger specimens mentioned above.

A striking feature of *I. sladeni*, to some extent shared by the type of *I. pristigastroides*, is the very elongate appearance of the head, shown well in Day's drawing (see Pl. 2). This is partly due to the length of the head but more particularly to

the more squat operculum (its height just over $2\frac{1}{2}$ times in head length; cf. 2–$2\frac{1}{4}$ times in other species). Also, the depth of the head, taken at right angles to the profile at the occiput, is much less (1 $\frac{2}{3}$ times in head length) than in other species ($1\frac{1}{4}$–$1\frac{1}{2}$ times).

A further difference between *I. sladeni* and *I. pristigastroides* is in the form of the swimbladder. In *I. sladeni* the swimbladder terminates at the posterior end of the body cavity (BMNH specimens of 209 and 308 mm S.L.), whereas in *I. pristigastroides* there is a postcoelomic, tapering prolongation down the right side of the body lateral to both the haemal spines and the anal pterygiophores and reaching as far as the level of the 15th branched anal ray. The condition in *I. sladeni* appears to be unique amongst Indo-Pacific members of *Ilisha* but it is found in the South American *I. furthii* (and probably also in the related *I. amazonica*—no BMNH specimens). The asymmetrical postcoelomic prolongation in *I. pristigastroides* is similar to that found in the Indo-Pacific *I. elongata* and *I. megaloptera*; in *I. africana* (West Africa) and *I. indica* (Indian Ocean) the prolongation of the swimbladder is bifid.

Family *ENGRAULIDAE*

6. *Engraulis auratus* Day, 1865

= *Thryssa dussumieri* (Valenciennes, 1848)

(Plate 2)

Engraulis dussumieri Valenciennes, 1848, *Hist. Nat. Poiss.*, **21** : 69 (no locality; putative neotype described by Whitehead, 1967 : 142); Day, 1878, *Fishes of India*: 627, pl. 158 (4) (*E. auratus* in synonymy); *Idem*, 1889, *Fauna British India, Fishes*, **1** : 391.

Thryssa dussumieri: Whitehead (in press), *Symp. Indian Ocean Adj. Seas. Mar. biol. Ass. India* (key, synopsis, fig.).

Engraulis auratus Day, 1865, *Proc. zool. Soc. Lond.*: 312 (Cochin on Malabar coast; on specimen $4\frac{6}{10}$ inches = 117 mm); *Idem*, 1865, *Fishes of Malabar*: 238, pl. 19 (2) (repeat; fig. (? life-size) $4\frac{1}{2}$ inches = 114·7 mm tot. l.).

MATERIAL.

a. ZSI (no specimens)
b. AMS (no specimens and none in *Great Fisheries Exhibition Catalogue* by Day, 1883)
c. NHMV (no specimens)
d. RMNH (no specimens)
e. ZMB.10412, a fish 89·7 mm S.L. (109·2 mm tot. l.), *ex* Bombay
f. BMNH.1867.5.30.13, a fish 83·1 mm S.L. (99·4 mm tot. l., caudal lobes damaged, estimated 103·3 mm), *ex* Madras, coll. Day
g. BMNH.1889.2.1.1779, a fish 90·6 mm S.L. (112·7 mm tot. l., caudal complete), *ex* Malabar, coll. Day (outside label altered from *E. auratus* to *mystax* Gthr.) (label inside jar, *Engraulis auratus* Malabar), LECTOTYPE

h. BMNH.1889.2.1.1780, a fish 55·2 mm S.L. (68·9 mm tot. l., caudal complete), *ex* Canara, coll. Day (label in jar, *Engraulis auratus* Canara)

In the *Fishes of Malabar* (p. vi) it is stated that a specimen of *E. auratus* had been deposited in the East India Museum (but apparently not in the British Museum). Manuscript catalogues and lists of zoological material presented to the museum of the East India Company are now in the British Museum (Natural History). One list of fishes is headed 'The following families are from Day's Malabar Fishes' and it includes *Engraulis auratus* from Malabar (preceded by the number 5, which seems to be an indication of the number of specimens). When the India Museum was dispersed in 1879, at least two of Day's presentations (birds and fish skins) were sent back to Day. Since no fishes were given to the British Museum at that time, Day probably also received back his spirit specimens, including *Engraulis auratus*. It is possible, therefore, that the specimen (or one of them) is that now in London and presented in 1889 (specimen g above).

There is a discrepancy of 2·3 mm between the length of the single specimen described in the original description and the length of the figure, which suggests that the figure was not exactly life-size. Since all four extant specimens are too small and there can be no certainty which, if any, contributed to the original description, we have chosen the British Museum Malabar specimen (g above) as lectotype.

Description. Based on the LECTOTYPE, a fish 90·6 mm S.L. (112·7 mm tot. l.) in good condition, *ex* Malabar, BMNH.1889.2.1.1779.

Br. St. 11, D I iii 10, P i 11, V i 6, A iii 32, g.r. 15 + 18, scutes 15 + 7.

In percentages of standard length: body depth 27·8, head length 26·9; snout length 3·6, eye diameter 6·4, length of upper jaw 41·1, length of lower jaw 19·3; pectoral fin length 18·1, pelvic fin length 11·1, length of anal base 33·0; pre-dorsal distance 49·0, pre-pelvic distance 42·2, pre-anal distance 59·3.

Body compressed, its width 3 times in its depth, the latter only slightly greater than head length; belly not strongly keeled, all but tips of scutes concealed by scaly sheath; head profile rising steeply from snout to nape and then more gradually to dorsal origin, belly profile evenly convex. Snout short, about $\frac{2}{3}$ eye diameter. Upper jaw very long, the right maxilla pointed posteriorly, reaching to pelvic base and about $\frac{4}{5}$ along pectoral fin (tip of left maxilla broken off); expanded portion of maxilla tapering rapidly behind 2nd supra-maxilla but with a membrane along upper edge; 2nd (posterior) supra-maxilla with upper part of expanded portion larger than lower; no 1st (anterior) supra-maxilla. Dentary symphysis below mid-point between eye and tip of snout; articulation of lower jaw $\frac{1}{2}$ eye diameter behind 2nd supra-maxilla. A single series of fine conical teeth on dentaries, pre-maxillae and along lower edges of maxillae except near tip; two (right) and three (left) conical teeth on vomer; fine granular teeth on tongue, palatines and on endo- and ecto-pterygoids.

Gillrakers fine, slender, the longest $1\frac{1}{4}$ times length of corresponding gill filaments and almost equal to eye diameter; 8 short, triangular rakers on posterior face of 3rd epibranchial: gillraker serrae on both 1st and 2nd arches in distinct clumps,

with the longest serae in the middle of each clump. Pseudobranch present, concealed by skin but with small posterior opening. Isthmus silvery, not bearing anterior members of scute series, tapering evenly to just behind posterior margin of branchiostegal membrane. Operculum $3\frac{1}{2}$ times as deep as broad, its posterior margin evenly rounded and not completely covering gill opening. Dorsal surface of head covered by thick layer of skin with numerous pores; posterior frontal fontanelles present, long and narrow, 2·1 mm by 0·5 mm (right).

Dorsal fin origin nearer to snout than to caudal base by 1 eye diameter; fin preceded by a small scute-like plate bearing a retrorse spine. Pectoral fin reaching just over $\frac{2}{3}$ along pelvic fin; axillary scale present, just over half length of fin. Pelvic fin base 1 eye diameter before vertical from dorsal origin and much nearer to pectoral base than to anal origin; axillary scale present, $\frac{4}{5}$ length of fin; a second triangular scale present, below fin, $\frac{1}{2}$ length of fin. Anal origin $\frac{3}{4}$ eye diameter behind vertical from last dorsal ray. Caudal peduncle a little deeper than long.

Scales: distinct anterior and posterior 'shoulders' to scale; unexposed portion with 10–12 irregular vertical striae, not interrupted at centre of scale, exposed portion with one semicircular striation but more frequently reticulated, especially in posterior scales, the reticulations finally covering the whole scale. Many elongate scales at base of caudal but no true alar scales.

Colour: general body colour silvery/gold, but brown where scales lost; dark brown venulose humeral area with peppering of dark pigment across back (as in Day's figure—see Pl. 2c). Fins hyaline except for narrow dark posterior border to caudal.

NOTE. The long maxilla, absence of the 1st supra-maxilla and distinct clumping of the gillraker serrae are characteristic of *Thryssa dussumieri* (descriptions in Whitehead, 1967 : 142, fig. 14c and 1968 : 23, fig. 2a), and Day (1878) later placed his *auratus* in the synonymy of that species.

TABLE 1

The clupeoid fishes in Day's *Fishes of India* and Day material in Calcutta, Sydney, London, Vienna, Berlin and Leiden

*present in collection (registration number given for possible types)

Species in *Fishes of India*	page	fig.	Identification	Zool. Survey, Calcutta	Austr. Mus., Sydney	Brit. Mus., London	Naturhist. Mus., Vienna	Zool. Mus., Berlin	Rijksmus., Leiden
CHIROCENTRIDAE									
Chirocentrus dorab	652	166 (3)	*Chirocentrus dorab* (Forssk., 1775)	*	*	*		*	*
CLUPEIDAE									
(Dussumieriinae)									
Dussumieria acuta	647	166 (4)	*Dussumieria acuta* Val., 1847	*	*	*		*	*
Dussumieria hasseltii	647	166 (5)	*Dussumieria acuta* Val., 1847	*	*				(as *elopsoides*)
(Clupeinae)									
Clupea klunzei	636	163 (1)	*Herklotsichthys punctatus* (Rüpp., 1837)	*	*	(as *moluccensis*)	*		
Clupea longiceps	637	161 (2)	*Sardinella longiceps* Val., 1847	*	*	*		*	*
Clupea melanura	641	—	*Sardinella melanura* (Cuv., 1829)						*
Clupea atricauda	636	164 (5)	*Sardinella melanura* (Cuv., 1829)	*		*	*		
Clupea brachysoma	635	163 (3)	*Sardinella brachysoma* Blkr., 1852		*		*		
Clupea fimbriata	637	161 (3)	*Sardinella fimbriata* (Val., 1847)	*	*	*	*	*	*
Clupea sindensis	638	163 (2)	*Sardinella sindensis* (Day, 1878)	ZSI.2630	AMS.B7642	BNMH.1889 2.1.1919–24		ZMB.10554 (as *venenosa*)	RMNH.2519
Clupea leiogaster	636	—	*Sardinella leiogaster* Val., 1847						
Clupea lile	638	162 (1)	*Escualosa thoracata* (Val., 1847)	*	*	(also as *argyrotaenia*)	*		

Corica soborna	642	162 (5)	*Corica soborna* Ham. Buch., 1822		*	*			*
(Pellonulinae)										
Spratelloides malabaricus	648	161 (5)	*Dayella malabarica* (Day, 1873)	ZSI.2246		BMNH.1889. 2.1.2048	(see also p. 85)		RMNH.2726
			Ehirava fluviatilis Deraniyagala, 1929		AMS.B8288	BMNH.1889. 2.1.2050–5		ZMB.10413	
(Alosinae)										
Clupea kanagurta	640	162 (4)	*Hilsa kelee* (Cuv., 1829)		*			*	
Clupea ilisha	640	162 (3)	*Hilsa ilisha* (Ham. Buch., 1822)	*	*	*	*	*	*
Clupea toli	641	162 (2)	*Hilsa toli* (Val., 1847)	*	*	*	*	*	
Clupea chapra	639	161 (1)	*Gudusia chapra* (Ham. Buch., 1822)	*	*	*		*	*
Clupea variegata	639	161 (4)	*Gudusia variegata* (Day, 1869)	ZSI.2245	AMS.B7676	BMNH.1870. 6.14.38			RMNH.2586
(Dorosomatinae)										
Chatoessus nasus	634	160 (4)	*Nematalosa nasus* (Bloch, 1795)	*	*	*	*	*	*
Chatoessus manmina	633	160 (2)	*Gonialosa manmina* (Ham. Buch., 1822)	*	*	(as *cortius*)	*	*	*
Chatoessus modestus	633	160 (1)	*Gonialosa modesta* (Day, 1869)	ZSI.2695	AMS.B7637	BMNH.1889. 2.1.1879			RMNH.2585
Chatoessus chacunda	632	160 (3)	*Anodontostoma chacunda* (Ham. Buch., 1822)	*	*	*	*		*
(Pristigasterinae)										
Pellona ditchela	644	165 (5)	*Pellona ditchela* Val., 1847		*		*		*
Pellona hoevenii	644	165 (6)	*Pellona ditchela* Val., 1847						
Pellona elongata	643	164 (3)	*Ilisha elongata* (Benn., 1830)		*	*	*		
		165 (1)							
Pellona leschenaulti	646	—	*Ilisha elongata* (Benn., 1830)						
Pellona indica	644	164 (4)	*Ilisha indica* (Swain., 1839)		*	(as *ditchoa*)	(as *ditchoa*)	*	
Pellona motius	643	165 (3)	*Ilisha indica* (Swain., 1839)			*	*		*
Pellona brachysoma	645	164 (2)	*Ilisha indica* (Swain., 1839)		*		*		

Pellona megaloptera	645	165 (2)	*Ilisha megaloptera* (Swain., 1839)	*	*					
Pellona filigera	643	165 (4)	*Ilisha megaloptera* (Swain, 1839)	*	*	*	*			*
Pellona sladeni	645	164 (1)	*Ilisha sladeni* (Day, 1869)	ZSI.2672		BMNH.1870. 6.14.36				
Opisthopterus tartoor	646	163 (5)	*Opisthopterus tardoore* (Cuv., 1829)	*	*	*				*
Raconda russelliana	646	163 (4)	*Raconda russeliana* Gray, 1831		*	*	*			*
ENGRAULIDAE										
Engraulis tri	630	158 (6)	*Stolephorus tri* (Blkr., 1852)	*	*	*				*
Engraulis indicus	629	158 (3)	*Stolephorus indicus* (van Hass., 1823)	*	*	(as *russellii*)	*			*
Engraulis commersonianus	629	158 (1)	*Stolephorus commersonii* (Lac., 1803)	*	*	*	*	*		*
Engraulis boelama	626	158 (7)	*Thrissina baelama* (Forssk., 1775)	*	*	*	*			
Engraulis setirostris	626	—	*Thryssa setirostris* (Prouss., 1782)							
Engraulis mystax	625	157 (3)	*Thryssa mystax* (Schn., 1801)	*	*	*	*	*		*
Engraulis purava	628	157 (2)	*Thryssa purava* (Ham. Buch., 1822)	*	*	*	*	*		*
Engraulis dussumieri	627	158 (4)	*Thryssa dussumieri* (Val., 1848)			BMNH.1867. 5.30.13 (*auratus*)	*	ZMB.10412 (*auratus*)		
Engraulis hamiltonii	625	157 (4)	*Thryssa hamiltonii* (Gray, 1835)	*	*	*		*		*
Engraulis malabaricus	625	157 (5)	*Thryssa malabarica* (Bloch, 1795)	*	*	*				*
Engraulis kammalensis	626	157 (1)	*Thryssa kammalensis* (Blkr., 1849)	*	*		*			
Engraulis taty	628	158 (5)	*Setipinna taty* (Val., 1848)			*				*
Engraulis telara	627	158 (2)	*Setipinna phasa* (Ham. Buch., 1822)	*	*	*	*	*		*
Engraulis breviceps	628	—	*Setipinna breviceps* (Cantor, 1850)							

Coilia ramcarati	631	159 (2)	*Coilia ramcarati* (Ham. Buch., 1822)	*	*	*				
Coilia cantoris	631	—	*Coilia ramcarati* (Ham. Buch., 1822)							
Coilia quadragesimalis	631	—	*Coilia ramcarati* (Ham. Buch., 1822)							
Coilia reynaldi	630	—	*Coilia reynaldi* Val., 1848							
Coilia borneensis	632	159 (1)	*Coilia reynaldi* Val., 1848	*	*					*
Coilia dussumieri	631	158 (8)	*Coilia dussumieri* Val., 1848	*	*	*				*
55 clupeoid species listed by Day			46 valid species amongst those recognized by Day	Calcutta, 39 species	Sydney, 40 species	London, 41 species	Vienna, 23 species	Berlin, 18 species	Leiden, 32 species	

Note: Dr. Gareth Nelson is describing a new species of *Nematalosa*, close to *N.nasus*. One of Day's specimens of *N.nasus* in the British Museum is this new species, *ex* Canara, BMNH. 1889.2.1. 1877.

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ADDENDUM

In 1889 the Zoological Institute in Leningrad received a large collection of Day Fishes, comprising 357 specimens (284 species). These were a gift from the British Museum (Natural History), presumably taken from the large collection presented to the Museum just before Day's death. Amongst these specimens are 32 clupeoids, including a paralectotype of *Spratelloides malabaricus* (see p. 64), making a total of 19 clupeoid species.

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